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## The Cuckoo Bee Genus *Kelita*, Its Systematics, Biology, and Larvae

JOAN EHRENFELD<sup>1</sup> AND JEROME G. ROZEN, JR.<sup>2</sup>

### ABSTRACT

Three new species (*toroi*, *penai*, and *tuberculata*) are added to the Chilean cuckoo bee genus *Kelita* heretofore thought to be monotypic (type species: *chilensis* Friese). Presented are descriptions of adults of all taxa, comparative illustrations of the male genitalia and other taxonomic features, a key to species, and a distribution map of the species. The anatomical parts of the complicated male genitalia are homologized. An attempt to analyze the phylogenetic relationships of *Kelita* to other Nomadini indicates that it is most closely related to *Paranomada*, *Triopasites*,

*Melanomada*, *Brachynomada*, and *Hesperonomada*. *Kelita tuberculata* and *chilensis* are reported to be parasitic on small panurgines. Details of adult and larval activity and larval development indicate that the biology of *Kelita* is not substantially different from that of other Nomadini. Taxonomic descriptions of the first and last larval instars of *tuberculata* reveal that these stages are similar in most respects to those of other Nomadinae although the mature larva, unlike the larvae of most members of the subfamily, bears paired dorsal body tubercles.

### RESUMEN

Se describen tres especies nuevas (*toroi*, *penai* y *tuberculata*) en el género chileno de abeja parásitica, *Kelita*, que se había considerado como monotípico hasta la fecha. Se dan descripciones de los adultos al nivel genérico y específico, y se presentan ilustraciones comparativas de la genitalia de los machos y de otros caracteres taxonómicos, así como una clave para la determinación de las especies, y un mapa de la distribución de las especies del género. Se establece la homología de los componentes de los complicados genitales del macho.

Un análisis tentativa de las relaciones filogenéticas de *Kelita* con otros Nomadini indica que está más intimamente relacionado con *Para-*

*nomada*, *Triopasites*, *Melanomada*, *Brachynomada* y *Hesperonomada*.

*Kelita tuberculata* y *chilensis* son parásitos de Panurginae pequeñas. Detalles de la actividad del adulto y de las larvas y el desarrollo larval demuestran que la biología de *Kelita* no es básicamente diferente de la de otros Nomadini. Descripciones taxonómicas del primer y del segundo estadio larval de *tuberculata* demuestran que estos estadios se asemejan en la mayor parte de sus caracteres a las de las larvas de otros Nomadinae, con excepción de un par de tubérculos dorsales encontrados en la larva madura que no se hallan en la mayoría de los componentes de la subfamilia.

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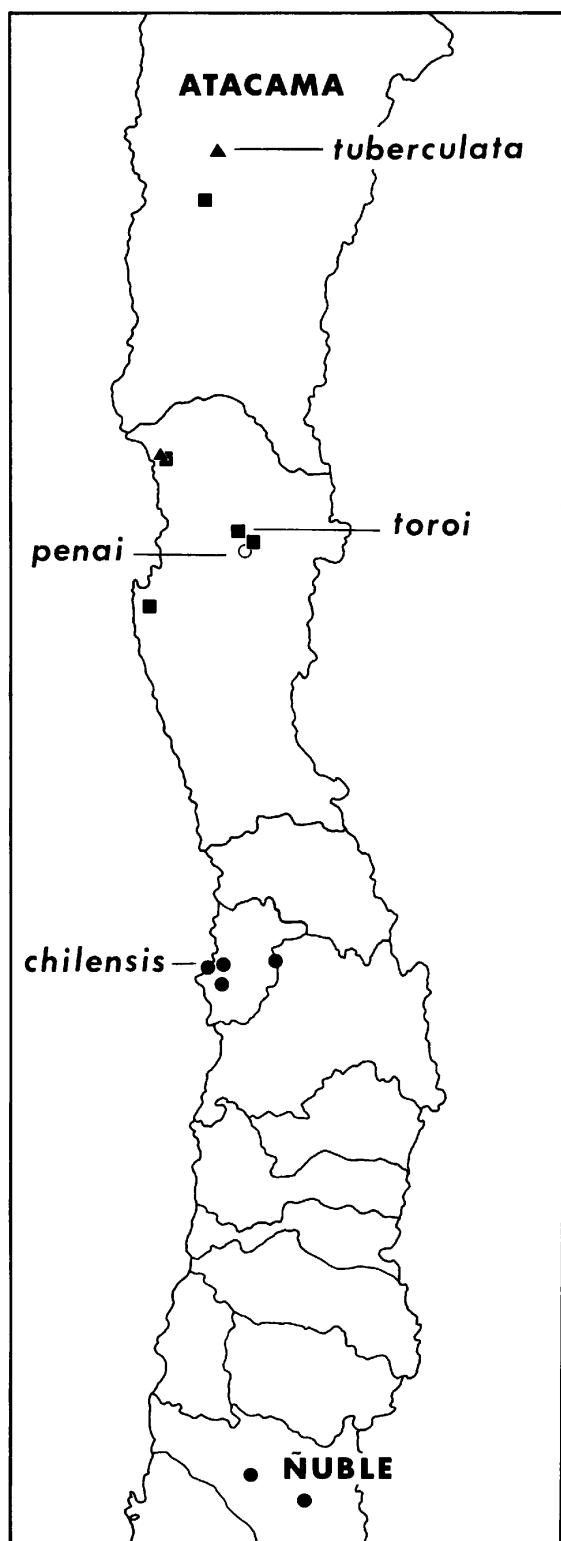
## INTRODUCTION

*Kelita* is the only known genus of small nomadine parasitic bees from Chile, a surprising fact when one considers that there are a dozen such genera from the arid parts of southwestern United States. Until now the genus was thought to include only one species, *chilensis*, so that the dearth of small nomadines in Chile seemed even more pronounced. On a recent trip to Chile, one of us (Rozen), with the able cooperation of persons listed below, sought out small panurgines and associated parasitic bees, particularly from Santiago Province north into Atacama Province. As a consequence, three distinctive new species of *Kelita* were discovered and are named in the present paper, which both treats the systematics of the genus and also describes its biology and immature stages.

One reason for having overlooked *Kelita* is that most bee collectors, not only in Chile but around the world, search for specimens on flowers. Nomadines are best netted as they fly over nesting areas, which usually are barren patches of ground. Also, only *chilensis* flies in the latitude of Santiago and farther south, where most bee collecting has occurred in the past. The other three species apparently are restricted to somewhat drier regions north of Santiago Province (fig. 1), an area not explored extensively for small bees until recently. With more searching, other species of *Kelita*, and perhaps other genera of small nomadines will undoubtedly be uncovered.

The first author (Ehrenfeld) is chiefly responsible for the systematic sections of this paper, the second author (Rozen), for those on biology and larvae. We acknowledge the assistance and cooperation of the following for their help in the field and/or for the loan of specimens: Dr. Andrew Moldenke, Division of Natural Sciences, University of California, Santa Cruz; Sr. Luis E. Peña, Santiago, Chile; Dr. Evert I. Schlinger, Division of Entomology, University of California, Berkeley; and Prof. Haroldo Toro,

FIG. 1. Map of Chile from Atacama Province to Ñuble Province, showing the distribution of the four species of *Kelita*: *chilensis*, closed circle; *penai*, open circle; *toroi*, square; *tuberculata*, triangle.



Universidad Catolica de Valparaiso, Valparaiso, Chile. Dr. Eberhard Konigsman, Institut für Spezielle Zoologie and Zoologisches Museum, Berlin, Germany, kindly lent the holotype of *chilensis*. Ms. Patricia Wynne illustrated the male genitalia, and Mrs. Marjorie Favreau and Mr. Ronald J. McGinley assisted with other aspects of the illustrations. Ms. Phyllis Browne ably typed and edited the manuscript. The field work as well as much of the laboratory work leading to the present paper was made possible through support from National Science Foundation Grant no. GB32193.

Holotypes and allotypes of new species are in the collections of the American Museum of Natural History, as are the immature stages of *tuberculata*.

## BIOLOGY

Although we have only limited knowledge of the biology of *K. chilensis* and *tuberculata*, we have sufficient information to provide a reasonably complete general picture of the life history of the genus.

**Host Association.** Both species are cleptoparasites on small panurgine bees, and it is likely that the entire genus is restricted to panurgines. Rozen (1970) first definitely identified *chilensis* as a parasite of *Psaenylitia parvula* Friese at Peñuelas, Valparaiso Province, Chile, based on both finding adults of this *Kelita* flying in association with the panurgine and on recovering an egg from the host cell wall. As early as 1916, Friese suggested, without being certain, that *chilensis* might be a parasite of *Liphanthus sabulosus* Reed (=*Psaenylitia rufiventris* Friese), and therefore, Rozen (1970) thought that *chilensis* might have several hosts. The specificity of host-parasite relationships of *Kelita* is still uncertain, however, and requires further study.

The host associations and other biological information regarding *tuberculata* were made at Paipote, Atacama Province, Chile, by Rozen. Both sexes were found flying swiftly close to the nearly horizontal, dry ground which was exposed to the sun throughout most of the day, in association with a small (somewhat less than 5.0 mm. long), undescribed species of *Liphanthus* on October 13, 1971. Another small panurgine belonging to a new genus and species near *Hetero-*

*sarus* and *Cephalurgus* was abundant on flowers in this area and may have nested in low numbers with the *Liphanthus*. However, the site was dominated by males and females of *Liphanthus* and numerous nests of it were found, all within 1 square meter. The site was excavated on October 20, 1971 and had several shallow nests with cells 5 to 9 cm. in depth, many of which contained eggs, larvae, and pupae of the panurgine. In no clearly identified nest of *Liphanthus* was any *Kelita* found, even though more than 10 burrows were examined. Toward the end of the same day, three larvae of *tuberculata* were recovered from a single nest at the edge of the nest site. Because of the absence of *tuberculata* from identified nests of *Liphanthus*, in contrast with the heavy parasitism in this single nest, there is doubt as to which of the two panurgines was the host of *tuberculata*; the *Kelita*-bearing nest may have belonged to the new panurgine genus.

**Adult Activity.** Adults of *chilensis* and *tuberculata* flew swiftly close to the ground of the nesting site as is characteristic of many other small Nomadinae. Specimens of all four species were collected during the period from mid-morning to early afternoon. As with all Nomadinae, the egg of *chilensis* (and almost certainly each of the other species as well) is embedded in the cell wall (Rozen, 1970). The shape of the eggs and the type of insertions in the cell wall appear to be genus-specific (if not tribe-specific) in the subfamily. *Kelita chilensis*, like *Nomada* and *Holcopasites*, deposits its elongate eggs, rounded at the anterior end, under a loose flap of the cell wall (Rozen, 1970, fig. 1). Because the egg is similar in general appearance to that of most other bees and because this characteristic is found not only in the Nomadini (*Kelita* and *Nomada*) but also in the Holcopasitini, it is probably a primitive feature for the subfamily, whereas the modified egg and egg insertion of such nomadines as *Epeolus* (Rozen and Favreau, 1968), *Pseudodichroa* (Rozen and Michener, 1968), and *Neopasites* (Torchio et al., 1967) are judged to be derived.

**Larval Activity.** The smallest of the three larvae died and desiccated before it could be carefully examined. When first excavated the anterior part of its linear body rose from the moderately firm, mealy moist pollen mass while its head was directed upward, and it opened and

closed its mandibles. This behavior has been observed by Rozen in early instars of other parasitic bees in this subfamily. From the same cell, the sclerotized head capsule of the first instar was recovered. The next largest larva, a third instar, was robust, not unlike the intermediate larvae of *Holcopasites*, and had the cast skin of the second instar adhering to it. Like intermediate larvae of all known Nomadinae, it exhibited bright yellow Malpighian tubules through the body wall. The largest larva was a last (presumably fourth) instar which started to defecate a day after capture and which was preserved on October 24, 1971, as a postdefecating form. Formal descriptions of the first and last larval instars are presented below. Subsequent examination revealed that the pupal tissue was developing within it at the time of preservation, a fact almost certainly indicating that it would soon have pupated and that the species is capable of producing more than one generation a year.

*Ontogenetic Changes in Larvae.* So far as is known, all first instars of the Nomadinae have special adaptations for attacking and killing the egg or larva (usually first instar) of the host. The cuckoo bee than molts and thereafter assumes the more typical appearance of a bee larva. The external anatomical changes that take place from the first instar to the second and those that take place with subsequent molts have not been recorded in detail for nomadines or, for that matter, for other groups. The larval material of *tuberculata*, though limited (one cast skin of first instar, one cast skin of second instar, one third instar, one last instar<sup>1</sup>), permits us to record some information regarding these changes and to speculate as to the function of various structures.

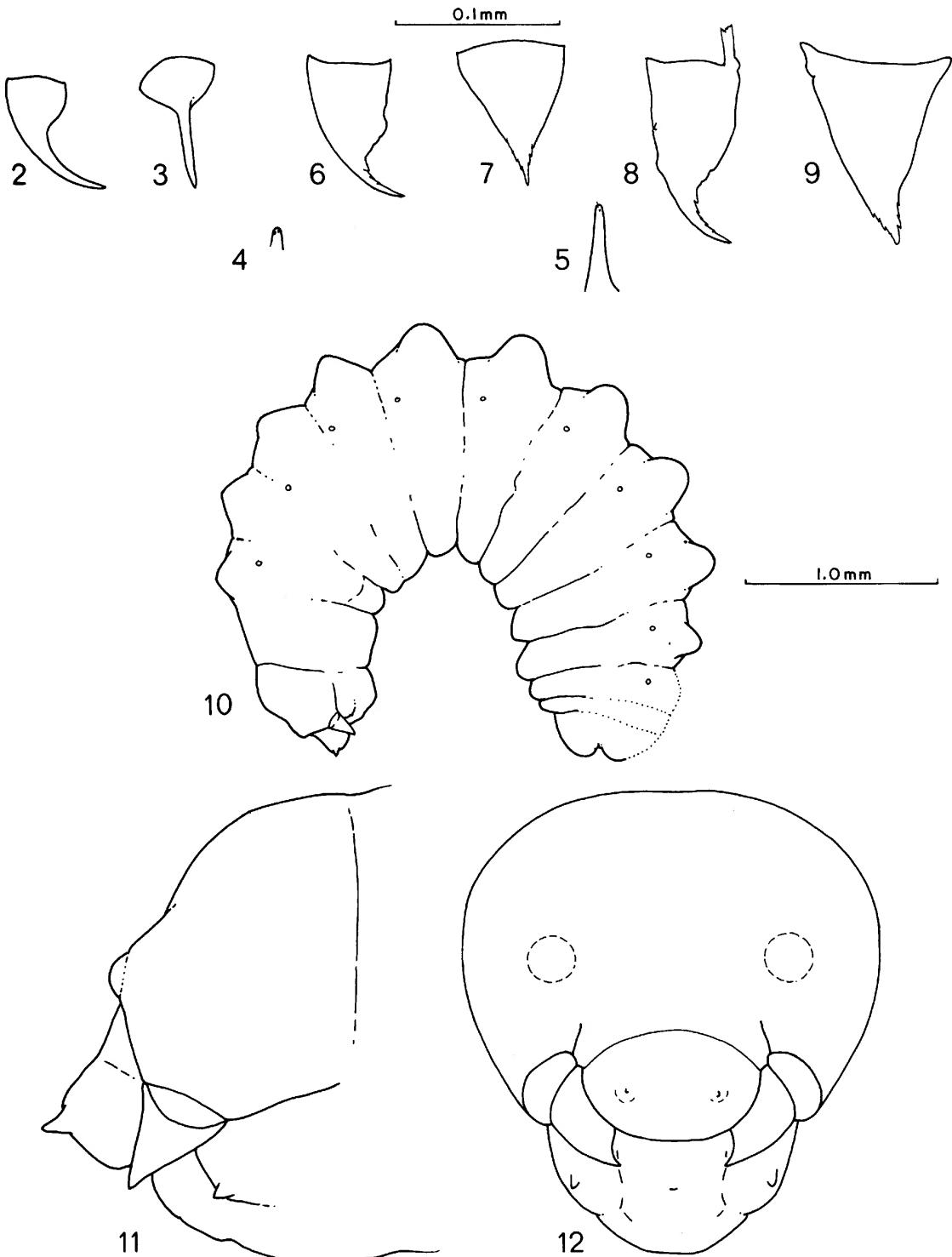
The head capsule, like that of other Nomadinae, possesses long, curved, sickle-shaped mandibles (figs. 2, 3) which destroy the young host. Its search for the host is probably dependent upon the greatly elongate, paired labral tubercles (fig. 5) which bear sensilla apically and jut out in front of the closed mandibles. Although the labial palpi are represented only by a pair of setae, the maxillary palpi (fig. 4) are large, arise

close to the base of the mandible, and are directed forward. Because of their position they probably serve as sensors informing the larva of the substrate beneath its head. The labiomaxillary region appears nonprotuberant so that the head capsule is probably flat beneath and prognathus in lateral outline. The antennae, each a weak swelling bearing four sensilla, presumably play no significant role in host location, as suggested by their small size. Almost certainly the body of the first instar lacks dorsal tubercles, because these structures are not present in the second and third instars, and because dorsal tubercles are not found on first instars of any bees. How the larva crawls is not known, although it may use the tip of its abdomen like a pygopod, as seems to be characteristic of other nomadines. Spiculation of the body is unstudied.

The features of the head and body change relatively little during subsequent stadia. The mandibles (figs. 6, 7) of the second instar are approximately the same length as those of the first instar; however, the mandibular base is much larger and the apex, now minutely serrated on both the dorsal and ventral edges, is much shorter. The mandible of the third instar (figs. 8, 9), though larger, is essentially the same as that of the second, as is probably that of the last instar. The labral tubercles of the second instar are much shorter than those of the first and remain that way in subsequent stadia. The maxillary palpi continue to be well developed in all instars. Although the labiomaxillary region is greatly fused in all stadia, it apparently increases in size from one to the next but is still clearly recessed even in the last stadium. The antennae become somewhat more pronounced in subsequent instars but even in the last the papilla is low. It consistently bears only four sensilla in the second and third instars. The salivary opening remains small throughout the larval period. Dorsal body tubercles, an unusual feature in the Nomadinae, are not present on either the second or third instars but are well developed on the last and possibly serve some function in larval orientation, as seems to be the case in the Panurginae. Integumental spiculation of the body surface is strongly developed in the second and third instars but is relatively inconspicuous in the last.

Presented below are formal taxonomic de-

<sup>1</sup>We assume that there are only four larval instars, but the number of instars for the Nomadinae has not been definitely established.



FIGS. 2-12. Larvae of *Kelita tuberculata*. 2. First instar, right mandible, dorsal view. 3. Same, aboral view. 4. Same, maxillary palpus, ventral view. 5. Same, labral tubercle, dorsal view. 6. Second instar, right mandible, dorsal view. 7. Same, aboral view. 8. Third instar, right mandible, dorsal view. 9. Same, aboral view. 10. Postdefecating larva, lateral view. 11. Same, head, lateral view. 12. Same, frontal view. Scales refer to figures 2-9 and 10, respectively.

scriptions of the last and first larval instars of *tuberculata*, the only species for which immatures have been collected. The adaptive function of some of the anatomical features of these instars as well as of the intermediate instars are discussed in the previous section.

### LARVAE OF *KELITA TUBERCULATA*

#### Mature Larva

Figures 10-12

This description is based on a single specimen; unfortunately the head capsule was destroyed before it could be examined minutely. Consequently details regarding spiculation, structure of the mandibles, sensilla, and tentorium cannot be provided. However, some of the missing information can be interpreted from the condition in the third instar and is given parenthetically below.

**Diagnosis.** This specimen keys to couplet 8 in Rozen (1966). This larva can be distinguished from all others in the subfamily (Rozen, 1966; Rozen and McGinley, 1974) except for that of *Paranomada* and *Isepeolus* because it possesses well-defined conical dorsal body tubercles. Smaller antennal papillae, shape of mandibles, and other features of *Paranomada* will probably serve to distinguish it from *Kelita*, after *Paranomada* is described. Although the larvae of *Isepeolus viperinus* (Holmberg) also possesses dorsal body tubercles, it is unique for the subfamily in that it also exhibits lateral body tubercles, a single labral tubercle, and a strongly produced labiomaxillary region with pronounced transverse salivary lips and elongate labial palpi.

**Description.** Body length approximately 4.0 mm.

**Head** (figs. 11, 12). Integument scarcely pigmented except for labral tubercles and maxillary palpi that are faintly brownish (in third instar, epipharynx, hypopharynx, maxillae, and labium nonspiculate). Head capsule not especially elongate as seen in lateral view; vertex as seen in lateral view moderately produced, more so than that of *Nomada*. Anterior tentorial pits evident and somewhat distant from precoila (in third instar, tentorium complete, extremely slender, in third instar posterior pits small, situated at junction of hypostomal ridge and posterior margin of

head capsule); all internal ridges of head capsule probably weak (hypostomal ridge of third instar moderately well developed but fading in vicinity of posterior tentorial pits); epistomal ridge mesiad of anterior tentorial pits apparently completely absent, conspicuous below pits. Parietal bands not observed. Antennal papilla rather pronounced convexity, rather larger and more conspicuous than that of *Nomada* (in instars one to three, papilla with four sensilla); antennal protuberance moderately developed. Labrum strongly projecting as seen in lateral view bearing two sharp-pointed tubercles; epipharynx swollen ventrally. Mandibles moderately slender, moderately short, broad at the base and tapering apically to simple apex (cusp of third instar moderately developed); both dorsal and ventral edges serrate. Maxillae recessed, broadly fused with labrum; maxillary palpus moderately developed; galea absent. Hypopharynx large and well defined, projecting farther than either maxillae or rest of labium below salivary opening, as seen in lateral view (fig. 11).

Labial palpus virtually or actually absent (that of third instar discernible only as a somewhat differentiated cuticular area bearing a single large sensillum). Salivary openings small, without lips, perhaps circular as is case with third instar.

**Body.** Integument extremely minutely spiculate in dorsal areas, spiculation somewhat more pronounced ventrally; a few minute, very short setae present at apices of dorsal tubercles. Form moderately robust, with head large in relation to body, in contrast to *Nomada* (Rozen, 1966), which has relatively small head; body not gradually tapering posteriorly, ending rather abruptly; intersegmental lines moderately deeply incised; paired dorsal tubercles present on most segments but situation for abdominal segments VIII, IX, and X not known because specimen damaged; tubercles moderately large, quite conspicuous, conical, and rounded; dorsal intrasegmental lines not evident; abdominal segment X not produced ventrally, central in attachment to segment IX; segment X moderately large and rounded ventrally; anus transverse, apparently apical; perianal area appearing as distinct, transverse, smooth lips. Spiracles moderately large, not on distinct elevations; atrium subglobular, projecting above body surface, with rim; atrial wall smooth; peri-

treme present, moderately narrow; primary tracheal opening with moderate collar; subatrium annulate, moderate in length; spiracle in general identical to that of *Nomada suavis* Cresson (Rozen, 1966, fig. 46). Imaginal discs of genitalia not visible.

**Material Studied.** One postdefecating larva, Paipote, Atacama Prov., Chile, October 20, 1971, preserved October 24, 1971 (J. G. Rozen).

#### First Instar Figures 2-5

This description is based on a single, cast-off head capsule retrieved from one of the cells. The features described below appear typical of what is known of the first instars of other Nomadinae.

**Head.** Maximum width approximately 0.15 to 0.20 mm. Integument somewhat pigmented, heavily sclerotized in contrast to rest of body, without long setae but with scattered sensilla. Posterior tentorial pits at juncture of posterior margin of head capsule and hypostomal ridge; other internal ridges weak or absent. Antennal papilla not defined, represented as a very low vague swelling bearing four sensilla. Labrum (fig. 5) with pair of greatly elongate tubercles bearing sensilla apically. Mandible (figs. 2, 3) greatly elongate, broad at base but tapering abruptly and then extending to long, curved, attenuate apex; apex without denticles. Labiomaxillary region apparently flat or nearly so and hence head probably prognathous in appearance; region probably less heavily sclerotized than dorsal area. Maxillary palpus (fig. 4) large, directed anteriorly, arising close to base of mandible; galea absent. Labium indistinctly fused with maxilla, with single sensillum representing each palpus; prementum and postmentum not defined. Salivary opening a simple hole.

**Material Studied.** One cast head capsule, Paipote, Atacama Prov., Chile, October 20, 1971 (J. G. Rozen).

#### SYSTEMATICS

##### GENUS *KELITA* SANDHOUSE

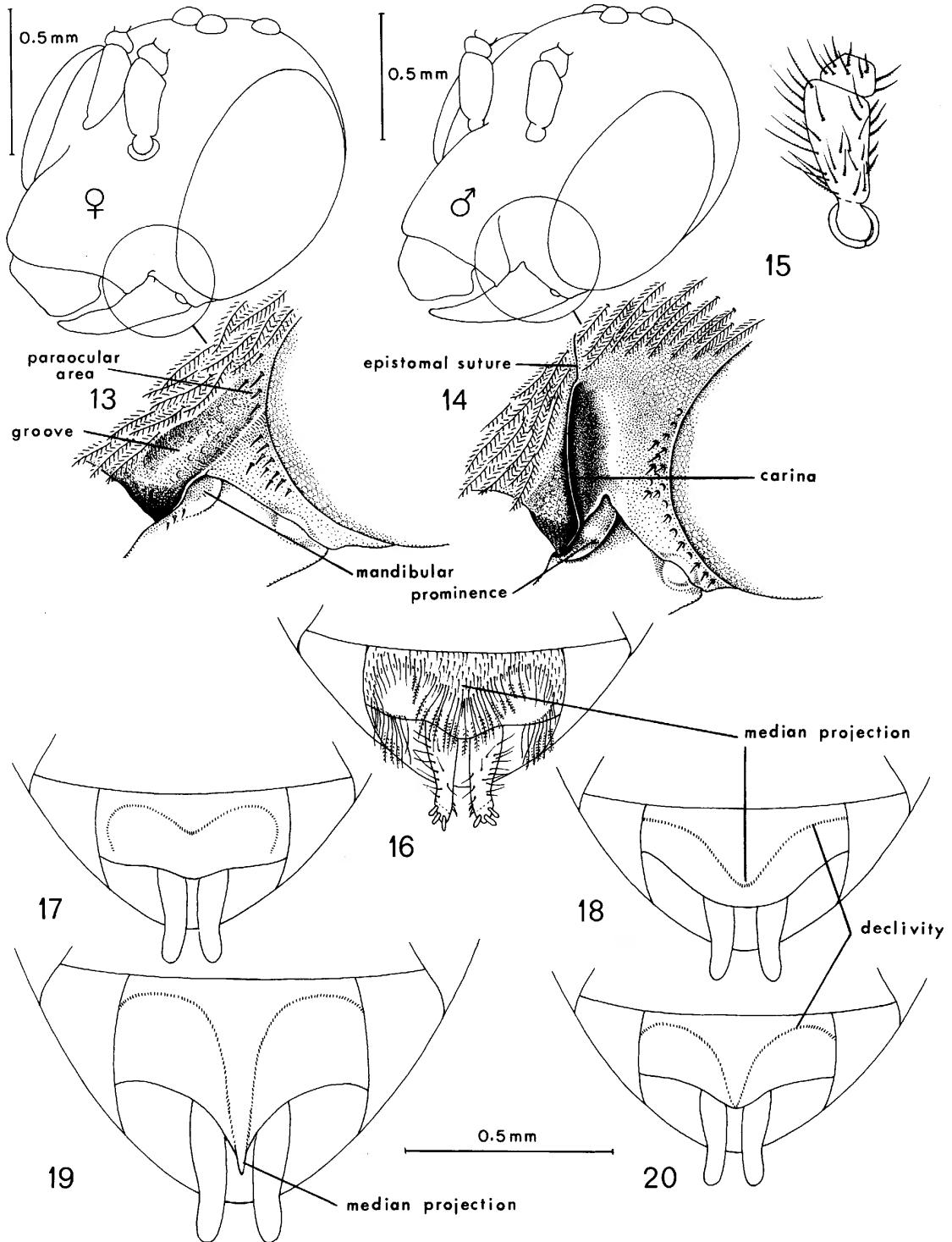
*Herbstiella* Friese, 1916 (type species *chilensis* Friese, 1916, by monotypy); Linsley, 1939, p. 6 (compared with *Hesperonomada*).

*Kelita* Sandhouse, 1943, p. 561 (replacement name; *Herbstiella* Friese preoccupied by *Herbstiella* Stimpson, 1871); Michener, 1944, p. 273 (assigned to the Nomadini).

**Diagnosis.** Adults of *Kelita* differ from all the other Nomadini (*Nomada*, *Hypochrotaenia*, *Melanomada*, *Triopasites*, *Hexepeolus*, *Hesperonomada*, *Brachynomada*, *Paranomada*) by (1) the pebbled sculpture of the head and very dull, silky sculpture of the metasoma; (2) the broad, non-flattened scape which is twice as long as its maximum width and abruptly narrowed at the base; (3) the short, thick, clavate hairs (figs. 24, 25) of the pseudopygidium in the female; and (4) usually its much smaller size. It differs from all of the above-named genera except *Hesperonomada* and some *Nomada* in having two submarginal cells; it can be distinguished from *Hesperonomada* by the long six-segmented maxillary palpi (*Hesperonomada* has a short five-segmented palpus) and by the rounded, nonlamellate mid and hind coxae (*Hesperonomada* has lamellate coxae).

**Description.** Form slender, not flattened, as is the case with *Paranomada*. Integument of vertex pebbled, that of mesoscutum moderately punctured, that of metasomal terga silky. Color of head and mesosoma black, that of metasoma red-brown to black. Pubescence of two types: short, strongly plumose decumbent hairs and long erect hairs which tend to be less plumose than short ones.

**Head.** Head broader than long as measured in frontal view, slightly broader than thorax as seen in dorsal view. Eyes large, twice as long as greatest width in lateral view, greatest width below midline. Frontoclypeal area variably protuberant; frontal line strongly impressed, similar to that of *Brachynomada*, more strongly than that of *Melanomada*. Female with more or less conspicuous ridge (fig. 13) extending from anterior mandibular articulation to lower inner orbit; immediately mesiad of ridge, more or less evident groove that continues to apicolateral edge of clypeus; male with ridge and groove absent; instead, paraocular area (fig. 14) between lower inner edge of eye and epistomal suture shining, glabrous, impunctate; area similar in appearance to that of *Hexepeolus*. Clypeus of male (fig. 14) but not of female carinate along lateral portions



FIGS. 13-17. *Kelita chilensis*. 13. Head of female showing details of paraocular area, clypeus, and mandible, anterolateral view. 14. Same, of male. 15. Scape and pedicel, anterior view. 16. Metasomal sterna V and VI, of female, ventral view. 17. Same, presented diagrammatically.

FIGS. 18-20. Diagrams of sterna V and VI of female, ventral view. 18. *penai*. 19. *toroi*. 20. *tuberculata*.

Scales refer to figures 13, 14, 16-20, respectively.

of epistomal suture; clypeus in male and to lesser extent in female produced as lamella overlying anterior articulation. Genae broad and rounded, as broad as two-thirds width of eye, similar in shape to that of *Melanomada* and *Hesperonomada*, but broader than in *Brachynomada*. Hypostomal groove with sides subparallel; convexity of space between groove and eye variable. Antennae inserted at or near level of middle of eyes, reaching mesoscutellum; scape (fig. 15) twice as long as broad at apex, abruptly narrowed toward base, robust, not flattened as in *Hesperonomada*; integument densely covered with broad shallow punctures with finely wrinkled sculpture between punctures, giving dull roughened appearance at low magnification; surface coarser than that of any other genus examined. Labrum broader than long; shape of apex variable; labrum more convex than in *Triopasites*. Mandibles simple, curved, with carina along inner surface; apices overlapping in repose; anterior basal angle slightly anterior to inner margin of eye or in line with inner margin of eye; anterior basal angle farther from eye than posterior basal angle, as in *Hesperonomada* and *Brachynomada*. Maxillary palpi long, longer than one-half of galeae, as in *Nomada*; palpi six-segmented; lengths of segments variable; stipites with single row of short setae on ventral edge.

**Mesosoma.** Dorsal lobes of pronotum, as seen from above, with angles formed by anterior and lateral edges about 125 degrees, similar to angles of *Hesperonomada*, *Melanomada*, *Brachynomada*, less obtuse than those of *Triopasites*; distance between lobes relative to shortest distance between tegulae variable; anterior faces of pronotum convex; mid-dorsal portion of pronotum visible from above; posterior lobes of pronotum yellow-brown, rest of pronotum black. Mesonotum convex, more strongly so than in *Brachynomada* and *Triopasites*, about as wide as long; medial line conspicuously incised, similar to that in *Hesperonomada*, more so than in *Melanomada* and *Brachynomada*; anterior lateral processes, viewed from above, one-half length of tegulae; parapsidal lines prominent as in *Brachynomada*, two-thirds as long as mesoscutum. Tegulae yellow-brown, transparent, broadly oval, one and one-half times as long as broad. Mesepisterna with lateral surfaces strongly convex, at rounded right angles to anterior faces. Subalar area slight-

ly smaller than pronotal posterior lobes, separated from posterior lobe by less than one-half width of lobe. Mesoscutellum long, about one-third as long as mesoscutum, strongly convex, more so than in other genera except *Hexepeolus*. Metanotum with median area convex, more dorsally placed than that of *Hexepeolus*, but less than that of *Hesperonomada*; metanotum one-half to less than one-third as long as mesoscutellum. Metanotum and dorsal area of propodeum as seen in lateral view sloping posteriorly at angle of 30 to 45 degrees. Propodeum with spiracles large, slightly anterior to middle of propodeum; dorsal ends of spiracles in vertical line with ventral ends; dorsal area glabrous, strongly rugose; posterolateral areas densely pubescent with short decumbent plumose hairs. Metasternum as long as broad, except in *toroi* longer than broad; metasternum with lateral edges converging posteriorly, except in *tuberculata* which has edges parallel; anterior end of metasternum produced into mesosternum as broad triangular process; posterior process short, less than one-fourth length of hind coxae, as in *Triopasites*, *Brachynomada* and *Hesperonomada*, shorter than in *Paranomada*, variably shaped; sternal pit just anterior to posterior process. Wing pigmentation variable; nerves dark brown. Stigma small; width from costa to posterior margin only slightly greater than distance from costa to prestigma; width of stigma at least twice distance from prestigma to costa in all other genera examined; ratio of length of stigma to its width about one and one-half times width, this ratio about 3:1 in other genera examined. Marginal cell much longer than distance from its apex to tip of wing; apex acute, very slightly separated from wing margin, with minute appendage similar to that in *Hesperonomada* and *Triopasites*. Submarginal cells two; second cell receiving both recurrent veins, shorter than, equal to, or slightly longer than first submarginal cell along posterior margin. Legs slender, segments not as robust as those of *Triopasites*. Tibiae of middle and posterior legs spiculate externally; spinelike setae moderately large, tending to be blunt-tipped, not so long and sharp as those of *Melanomada*, and not spatulate like those of *Paranomada*; apex of mid and hind tibiae produced on outer posterior edge as truncate to emarginate lamellae. Coxae of mid and hind legs rounded in both male and female,

not lamellate as in, for example, *Hesperonomada* or *Melanomada*. Posterior tarsi with first two segments shorter than length of tibiae; basitarsi as long as remaining segments together, four times as long as apical width. Claws with large, broadly based inner tooth, two-thirds as long as outer claw; arolia broad at tip, one-half to two-thirds as long as claws.

**Metasoma.** Form slender, widest at second tergum, tapering posteriorly abruptly. Posterior lateral angles of tergum I about one-half width of sternum I, larger than in *Hesperonomada* and *Melanomada*, broadly rounded; tergum I tapered anteriorly to base; anterior face of tergum I at angle of 45 to 60 degrees from horizontal, slightly convex, without transverse carina, with a longitudinal basal median sulcus. Female: Tergum V with median raised, oval to semicircular pseudopygidial area; this area covered with short, thick, spatulate, curved hairs around the periphery, tapering thinner hairs centrally (figs. 24, 25). Pygidium large, apically emarginate or truncate. Sternum V (figs. 16-20) with curved transverse raised ridge bordered by row of long plumose hairs; this ridge produced posteriorly along midline of sternum in narrow, variably acute projection; this process longer, more conspicuous than in any other genus examined. Sternum VI (fig. 21) with paired lobes long,

slender, flattened, having three or four spines around each acute apex, long slender hairs along interior and exterior edges. Male (figs. 27, 28, 31, 32, 35, 39, 40): Pygidial plate long, apically rounded. Gonobase broad dorsally, greatly reduced ventrally. Gonocoxites quadrate; anterior ventral apodeme variably produced; posterior margin deeply inflexed. Gonostyle variously developed. Penis valves large, exserted beyond gonocoxites, angled dorsoventrally; surface of apex broadened and flat.

#### Explanation of Some Taxonomic Characters

The anatomy of certain structures of systematic importance requires explanation. Specifically, these structures are (1) the modifications of the clypeus, mandibles, and parocular areas in both sexes; (2) metasomal sternum V of the female; and (3) the external male genitalia. Italicized anatomical terms below refer to labels on appropriate figures.

In the female (fig. 13), the lower part of the *parocular area* is shallowly concave along the inner margin of the eye. The concavity extends below the malar area, onto the clypeus, and ends at the apex of the clypeus. This trench, referred to as the "parocular groove" in this paper, is especially abruptly depressed along the anterior

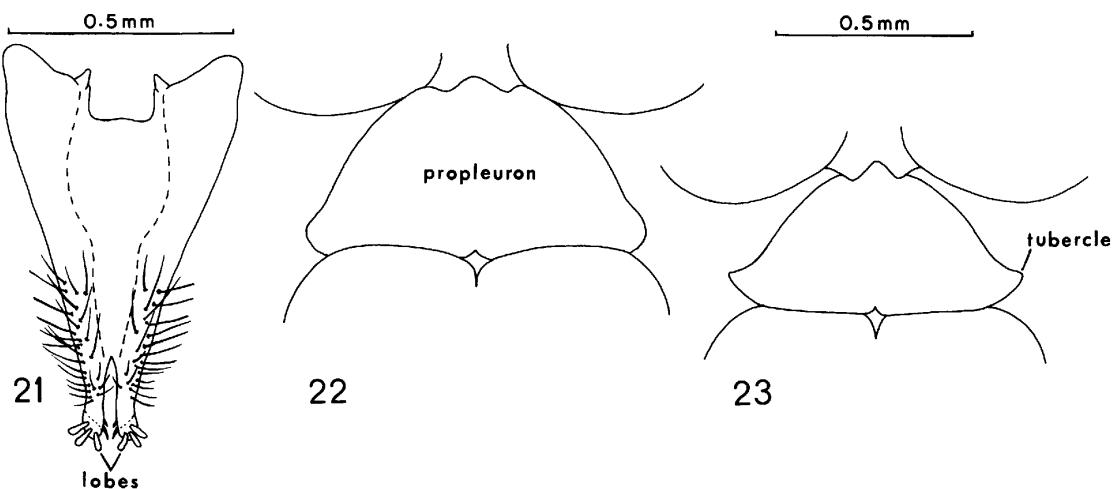


FIG. 21. *Kelita chilensis*, metasomal sternum VI of female, ventral view.

FIG. 22. *Kelita toroi*, propleura, ventral view.

FIG. 23. *Kelita tuberculata*, same.

Scales refer to figures 21 and 22-23, respectively.

border of the malar area, so that the junction between the trench and the malar area appears to be a low ridge. The area is sparsely punctate, dull, and has a few scattered setae. Linsley and Michener (1939) first mentioned the presence of the paraocular groove in the Nomadini, and considered it an important character in grouping the genera of the tribe.

In the male (fig. 14), the paraocular area is flat; that is, it is not depressed below the level of adjoining portions of the face. The integument is glabrous, impunctate, and highly polished, unlike that of the female. Although this character is seen in the males of some other nomadines (*Melanomada*, *Hexepeolus*, *Paranomada*), it is more strongly developed and more conspicuous in *Kelita* than in any other genus except *Hexepeolus*.

The lateral portion of the epistomal suture becomes vestigial in both sexes at least of *chilensis*, disappearing about halfway between the anterior tentorial pit and the mandible. In the male (fig. 14), there is a well-developed *carina* on the clypeus along the line generally followed by the suture; however, we have been unable to see the suture itself. The carina is maximally enlarged along the borders of the glabrous paraocular area.

In both sexes, the lateral edge of the clypeus is expanded as a rounded, rather thick lamella which overlies the anterior mandibular articulation. In the male this lamella arises at the lateral end of the epistomal carina (fig. 14). The lamella is smaller in the female.

In the male the surface of the mandible underlying the clypeal lamella and just distad of the anterior mandibular articulation is shaped as an enlarged, round prominence, demarcated posteriorly by a thin carina. Thus, it appears as if the clypeal lamella and this anterior *mandibular prominence* slide across each other as the mandible opens and closes. In the female a similar but less-developed prominence is present which bears the same relations to the clypeal lamella but is not carinate.

In the male but not the female the anterior mandibular articulation is produced as an acute projection which fits into a complementary concavity in the head capsule (fig. 14). The surface of the head around this concavity forms a rough-

ly triangular mound which grades into the glabrous paraocular area and the malar area.

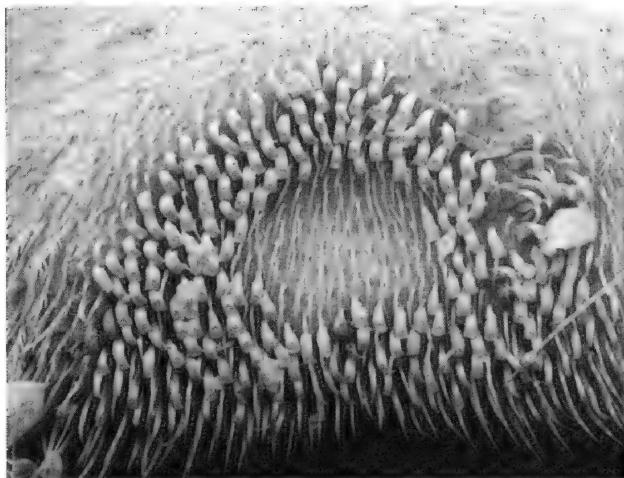
The portion of the clypeus just mesiad of the clypeal lamella is strongly concave in both sexes. In the female it appears simply as a continuation of the paraocular groove. The clypeal groove is no different in form in the male, but it originates at the epistomal carina.

The function of these facial characters is unknown. Because the clypeal lamella and the mandibular prominence evidently shear against each other, and because these shearing surfaces are larger in the male than in the female, they might be involved in courtship and/or mating.

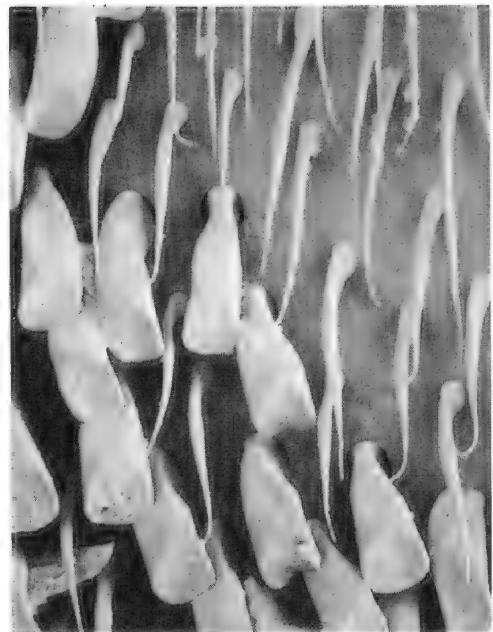
The pseudopygidium in females of all species of *Kelita* is raised above the level of the tergum, and possesses highly modified setae around its periphery (figs. 24, 25). We have seen nothing like them in any other Nomadini. These setae are round in cross section, very thick at the base, strongly curved, and spatulate or flattened at the apex. Because they bend posteriorly, the periphery of the pseudopygidium looks like a textured surface under the microscope, rather than like an area of pubescence. In the center of the ring are simple, tapered, curved setae.

Metasomal sternum V in the females of all four species bears characters unique to *Kelita*, and also shows variation among the species (figs. 16-20). A low median ridge arises laterally in the middle of the sternum and curves posteriorly; the ridges from each side of the sternum meet in the center to form a median projection. The apical integument is thin, transparent, unsculptured, and is most easily seen under fluorescent light. The curving lateral ridges and the central prominence may be fringed with long plumose setae. The apex of the sternum parallels this median ridge.

The *gonobase* forms the proximal end of the external male genitalia. It is well-developed dorsally but narrows laterally and fades apparently completely on the venter. Attached to the gonobase are the *gonocoxites*, the dominant features of the external genitalia which are armed apically with a number of structures, some of which cannot be certainly identified. The median semi-membranous *penis* and adjacent paired sclerotized *penis valves* are unmistakable however, being similar to those of many other bees. On the



24



25

FIGS. 24, 25. *Kelita tuberculata*, pseudopygidial area of female. 24. Entire pseudopygidium, dorsal view, 200 $\times$ . 25. Tangential view, showing peripheral thick and central fine setae, 920 $\times$ . (Chile; Coquimbo, Llano de la Higuera, north of El Tofo, October 14, 1972, J. G. Rozen and L. Peña, collectors.)

ventral surface of the genitalia of *Kelita chilensis* (fig. 27) and *penai* can be seen a pair of paramedian lobes, each near the posterior median angle of the gonocoxite. Apparently also present in the other two species though not visible in ventral view, these are probably the *vosellae*, which are also present in *Nomada* according to Michener (1944). Laterad of each penis valve can be found a small but well-defined outgrowth of the gonocoxite, the *gonocoaxal lobe*. The remaining structures at the apex of the gonocoxite, all laterad of the gonocoaxal lobe, are here regarded as a multiprocessed *gonostylus*, which exhibits considerable specific variation. In all species the gonostylus seems fused with the gonocoxite although a conspicuous pigmented *suture*, present in all species, may mark the boundary of the two structures. The fact that the suture disappears ventrally and there is no clear articulating membrane between the gonocoxite and the gonostylus, however, leaves some doubt as to whether the latter structure is indeed a gonostylus. The parts of the gonostylus are as follows: a *dorsal process*, which is elongate in *K. chilensis* and

*penai* but scarcely present in *toroi* and *tuberculata*; a *median process*, which is conspicuously bifurcate in all species except *toroi*; and a *ventral process*, which in all species is small but present and bears a number of setae.

#### A Speculative Phylogeny of the Nomadini

We present here a preliminary cladistic analysis of the Nomadini. The tribe, as here defined, includes the genera assigned to it by Michener (1944). However, the reader should bear in mind that Rozen (In press) in a study of the larvae of the tribe shows evidence that *Nomada* (and presumably *Hypochrotaenia*) is not a sister group of the other "Nomadini." The following conclusions are based on 21 characters of adult specimens in the collection of the American Museum of Natural History. Although many characters were found that separated the various taxa, relatively few had alternative states that were clearly plesiomorphic and apomorphic. The designations of character states given in table 1 range from highly probable to speculative, and

we report the following analysis diffidently, hoping that it will provide the basis for more intensive study of the tribe.

Table 1 lists those characters that were used in the analysis; numbers in parentheses below refer to the characters listed in this table. The basis for assigning character states as plesiomorphic or apomorphic is also given. Any character state common to other tribes within the Nomadinae or

other families of bees was considered plesiomorphic by out-group comparison. Character correlation was used to assign evolutionary status to those characters with no clear trends of occurrence in related groups.

Figure 26A shows the most parsimonious cladogram; figure 26B is a branching diagram in which the length of the line equals the number of autapomorphies and synapomorphies present be-

TABLE 1  
Characters Used in Constructing a Phylogeny of the Nomadini  
Determination: 1= out-group comparisons with other Nomadinae; 2= out-group  
comparisons with other Apoidea; 3= character correlations  
(For explanation, see text.)

Plesiomorphic	Apomorphic	Determination
1. Body convex	Dorsally compressed	1
2. Integument lacking maculations	With maculations	1
3. Integument variously sculptured, but not pebbled	Pebbled	1
4. Possessing only erect simple or plumose setae	Possessing at least some decumbent setae	3
5. Paraocular area of female flat	With groove	3
6. Male lacking carina bordering lateral epistomal suture	Possessing carina	1
7. Clypeus produced laterally as lamella overlying anterior basal angle of mandible	Lamella lacking	1, 3
8. Antennal scape cylindrical	Conical	1
9. Antennal scape round	Flattened	1
10. Surface of mandible smooth, unmodified	Oval depression at base of mandible on anterior angle	
11. Maxillary palpus with six segments	a) With 5 subequal segments b) With 5 segments, apical segment much smaller than others c) With 4 segments	2
12. Maxillary palpus long, at least one-half of length of galea	Short, less than one-half length of galea	3
13. Three submarginal cells	Two submarginal cells	2
14. Hind tibia externally spiculate	Smooth	1
15. Apex of hind tibia with lamella	Apex rounded	3
16. Lobes of metasomal tergum I overlying sternum, not expanded in size	Lobes very large, projecting over sternum as loose flaps	1
17. Metasomal sternum I weakly convex, unmodified	With medial raised, triangular, pubescent area	1
18. Second metasomal sternum unmodified	With raised, medial pubescent area	1
19. Pseudopygidium uniformly covered with tapered thin setae	Periphery of pseudopygidium with thick, clavate, curved setae	1
20. Female sternum V rounded apically	a) With apical projection b) With subapical projection	1
21. Female sternum VI apically truncate	Produced as two slender parallel lobes armed with several thick setae	1

tween the branchings and is intended to give a general impression of the amount of evolutionary change that has taken place. Plain numbers refer to apomorphic character states and show the points at which each appears; the underlined number (leading to *Paranomada*) is a reversal to a primitive character state, as described below.

*Nomada* and *Hypochrotaenia* retain many of the primitive features of the ancestral nomadine line, diverging only in two autapomorphies (2 and 16). The sister group to *Nomada* and *Hypochrotaenia* acquired the carina bordering the epistomal suture in the male (6). After the *Hexepeolus* lineage branched, the other lineage

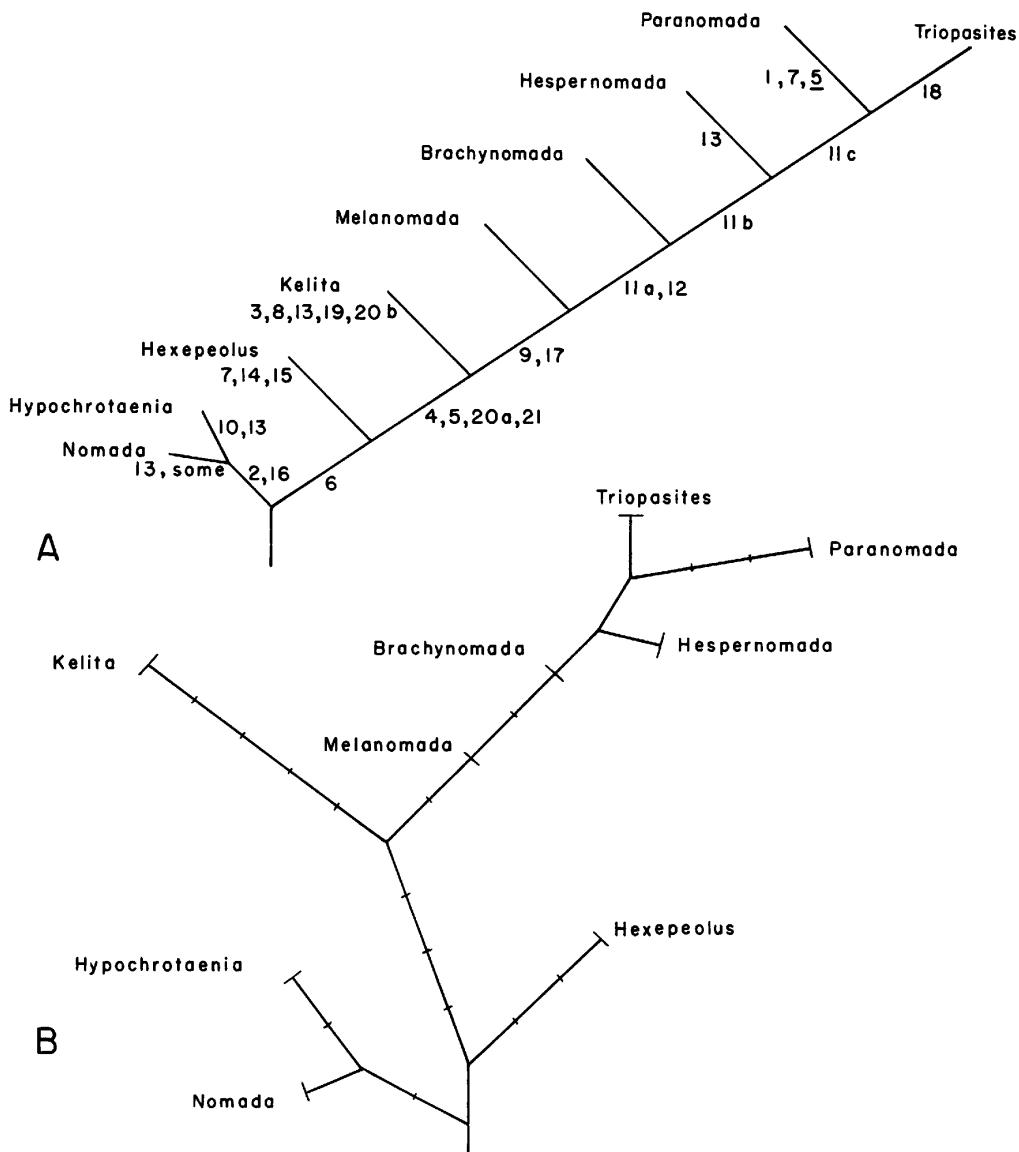


FIG. 26. Cladistic and phylogenetic understanding of the Nomadini based on adult characters listed in table 1. A. Cladogram. B. Branching diagram in which the sequence of branching is the same as in the cladogram; length of line approximates the amount of evolutionary change as based on the number of synapomorphies and autapomorphies; direction of line and size of angle have no meaning. For further explanation, see text.

developed modifications of female metasomal sterna V (20 a) and VI (21), areas of decumbent setae (4), and paraocular areas with grooves (5). In view of the number of similarities between *Paranomada* and the other genera depicted near it in figure 26B, we speculate that the flat paraocular areas (5) of *Paranomada* are a reversal. It seems unlikely that the groove was a primitive character for the Nomadini, repeatedly and independently lost in *Nomada* plus *Hypochrotaenia*, *Hexepeolus*, and *Paranomada*.

*Kelita* diverged from the rest by evolving a number of autapomorphic characters: pebbled sculpture (3), two submarginal cells (13), modified setae of the pseudopygidium (19), conical shape of the scape (8), and subapical production of sternum V (20 b). The complex structure of the gonostylus is also undoubtedly a derived character, but since comparable information was unavailable for some genera, it has not been included in the formulation of the cladogram or branching diagram. The subapical modification of sternum V in the female (20 b) is here interpreted to be a modification of an apical production (20 a), which is itself seen as a state derived from an unmodified sternum.

The sister group of *Kelita* is defined by the development of a flattened scape (9) and a modified metasomal sternum I (17). Subsequent branching primarily involved sequential reduction in the number of segments of the maxillary palpus and reduction in palpal length. In *Melanomada*, the palpus is long and six-segmented, as in the preceding genus. In *Brachynomada*, the palpus is shortened (12) and has lost a segment (11 a). In *Hesperonomada*, the fifth segment is minute (11 b), and in *Paranomada* and *Triopasites*, four subequal segments remain (11 c). We thus interpret the condition seen in *Hesperonomada* (11 b) as an intermediate stage between a short five-segmented and a short four-segmented palpus.

There have been two main radiations during the evolution of the Nomadini as currently defined. One such radiation involved the *Nomada-Hypochrotaenia* complex and was characterized by the massive proliferation at the species level. This complex is primarily Holarctic in terms of preponderance of species, although *Hypochrotaenia* does extend into South America. The other radiation is represented by the sister group

to this complex, that is, the other Nomadini. Strictly New World, it contains at least seven genera but each genus consists of only a few species.

We have not attempted to interpret the phylogeny of the species of *Kelita*. After careful review of all taxonomic features, we concluded that there were insufficient characters whose states could be identified as plesiomorphic or apomorphic to permit even a tentative cladistic analysis.

#### KEY TO THE SPECIES OF *KELITA*

1. Metasoma red-brown contrasting with blackish color of mesosoma; upper part of metepisternum with very fine suberect nonplumose or scarcely plumose setae which do not obstruct integument to same extent as strongly plumose setae of upper part of mesepisternum; dorsal process of gonostylus (fig. 28) elongate, longer than other processes of gonostylus. . . . . 2  
Metasoma with terga blackish except for some posterior marginal areas, hence metasoma essentially concolorous with mesosoma; upper part of metepisternum clothed in decumbent, strongly plumose setae which obscure integument nearly to same extent as setae on upper part of mesepisternum; dorsal process of gonostylus (fig. 36) inconspicuous, much shorter than other processes of gonostylus. . . . . 3
2. Posterior margin of first submarginal cell shorter than or as long as that of second; decumbent pubescence of head and thoracic pleura yellowish, dense; length at least 3.5 mm. . . . . *chilensis* (Friese)  
Posterior margin of first submarginal cell longer than that of second; decumbent pubescence of head and thoracic pleura whitish, sparse; length less than 3.5 mm. . . . . *penai*, new species
3. Each propleuron with prominent ventrolateral tubercle (fig. 23); male with median process of gonostylus conspicuously bifurcate (figs. 39, 40); length less than 5 mm. . . . . *tuberculata*, new species  
Each propleuron with ventrolateral edge (fig. 22) rounded, not tuberculate; male with median process of gonostylus large and apparently not bifurcate (figs. 35, 36); length greater than 5 mm. . . . . *toroi*, new species

*Kelita chilensis* (Friese)

Figures 16, 17, 27-30

*Herbstiella chilensis* Friese, 1916, pp. 168-169,  
female.

*Kelita chilensis*, Sandhouse, 1943, p. 561.

**Diagnosis.** This species closely resembles *Kelita penai*; it can be distinguished from the latter by the combination of the following features: its larger size, the wider interpuncture spaces of the mesoscutum, the greater density of the decumbent pubescence, and the length of the first submarginal cell along the posterior margin being less than or equal to the corresponding length of the second submarginal cell. The males of *chilensis* can be recognized because the distal prominence of the penis valve is halfway between the proximal prominence and the apex of the valve, as seen in lateral view (fig. 28).

**Female.** Length 3.9-4.3 mm.

**Head.** Head black, except: labrum, proboscis, basal two-thirds of mandible and apical edge of clypeus yellow-brown, apex of mandible red, flagellum dark brown. Short decumbent plumose hairs yellowish; these hairs densely distributed over genae and over most of face except malar area, apex of clypeus, and upper part of face to level equal to length of scape. Long, erect hairs yellowish, and present on all surfaces of head except eyes. Portion of vertex between eyes and lateral ocelli, as seen from front in outline, slightly rounded, unlike that of *penai*. Gena, as measured in lateral view at mid-eye level, one-half as wide as eye. Antennae inserted slightly below middle of eyes, lower than in *penai*; mid-flagellar segments with length greater than width. Supraclypeal area protuberant, strongly pebbled; punctuation obscured by pubescence; length of supraclypeal area, as measured from dorsal portion of epistomal suture to antennal socket, about one-third dorsoventral length of clypeus measured medially. Frontal line not so prominent as that of *penai* or *tuberculata*. Clypeus strongly protuberant, slightly more than twice as broad as long; punctures near apex large, small elsewhere; integument shining between punctures. Ventral surface of head strongly tessellate, almost pebbled; pubescence sparse, short, erect. Hypostomal groove, as seen from below, twice as broad at anterior edge as distance from

anterior edge of groove to ventral margin of eye. Mandible with anterior basal angle slightly anterior to inner edge of eye; mandible tapering to narrow tip; distance between basal angles greater than one-half length of mandible. Labrum slightly convex, much less so than in *penai*, slightly wider than long; apical margin rounded medially, straight laterally; surface of labrum with paired pyramidal mounds. Proboscis long, in repose extending nearly to anterior coxae. Maxillary palpi with segments subequal, except fourth segment, which is shorter; maxillary palpi shorter than stipites, slightly more than one-half length of galeae.

**Mesosoma.** Propleuron with ventrolateral edge lacking a tubercle as described for *tuberculata*. Mesoscutum slightly bronze-metallic; disc with deep punctures separated by less than one puncture width on anterior half, one puncture width on posterior half; interpuncture space weakly pebbled; short yellowish decumbent plumose hairs along posterior edge, extending along medial sides of parapsidal lines, and variably present in medial area bounded by parapsidal lines; long erect yellow hairs present throughout mesoscutum. Scutellum with disc having large punctures two to three puncture widths apart; integument faintly pebbled, slightly bronze-metallic between punctures; scutellum covered with variable amount of yellowish short decumbent plumose hairs and with sparse long hairs. Mesepisternum densely covered with decumbent long plumose hairs, which are yellowish dorsally and white ventrally. Metanotum less than one-third length of mesoscutellum, densely covered with yellowish short plumose hairs, sparsely covered with long erect hairs. Dorsal portion of metepisternum densely covered with decumbent plumose hairs. Metasternum broader than long, with posterior process short, narrowly rounded. Horizontal area of propodeum wider than metanotum; pubescence of propodeum yellowish. Wings faintly infuscated throughout but darkest at tips; second submarginal cell as long as, or slightly longer than, first submarginal cell along vein M; length of second submarginal cell along vein R one-half length along vein M; first recurrent vein entering second submarginal cell at point one-third total length of cell along vein M. Legs dark brown except: apices of coxae, trochanters and femora,

apices and bases of tibiae, inner surfaces of tarsi of mid and hind legs yellow-brown; procoxae with short, white plumose decumbent hairs moderately dense; hind tibia with two adjacent outer apical lamellate projections.

**Metasoma.** Terga I and II uniformly red-yellow; terga III to V dark brown basally, yellow-brown apically. Sterna yellow-brown. All terga with scattered short plumose yellow hairs in patches laterally; fine, short, simple erect hairs present medially and laterally. Anterior face of tergum I, as seen from side, slightly convex, tapering anteriorly, at angle of 60 degrees to horizontal. Pseudopygidium narrowly oval, rounded along apex of tergum, longer than broad, blackish. Pygidium reddish brown, with sparse long, thin yellowish hairs, apex narrowly truncate, slightly emarginate. Sternum V (figs. 16, 17) with central prominence broadly tapering posteriorly to narrowly rounded point terminating well anterior to posterior margin; border of prominence curving laterally across middle of sternum; border demarcated by row of long plumose off-white hairs. Posterior lobes of sternum VI (fig. 21) light brown, except tips dark brown; lobes sparsely pubescent with scattered long fine hairs on lateral edges; apex of each lobe with approximately four dark brown spurlike setae.

**Male.** Length 3.8-4.3 mm.

As described for female except: antennal segments broader than long, conspicuously marked with small light spots on outer surfaces; antennae slightly shorter than in female. Pygidium brown, two times as long as apical width; pygidium with broad punctures close together; hairs short, sparse, yellowish. Gonocoxites with length one and one-half times width; gonocoxal apodeme strongly produced (figs. 27, 28). Gonostylus possessing dorsal, median, and ventral processes (figs. 27, 28); median process bifurcated into shorter cylindrical inner lobe and larger rounded outer lobe; dorsal process thicker than that of *penai*. Penis valve each with two obtuse prominences on dorsal surface, one at point just distad of gonocoxite, one at point where valve bends ventrally.

**Material Studied.** Holotype female, one female Zorras, near Valparaiso, November 1, 1910 (P. Herbst); one female, Hacienda Illapel, 6-900 m., 31° 36'S-71° 07'W, Coquimbo Prov., October

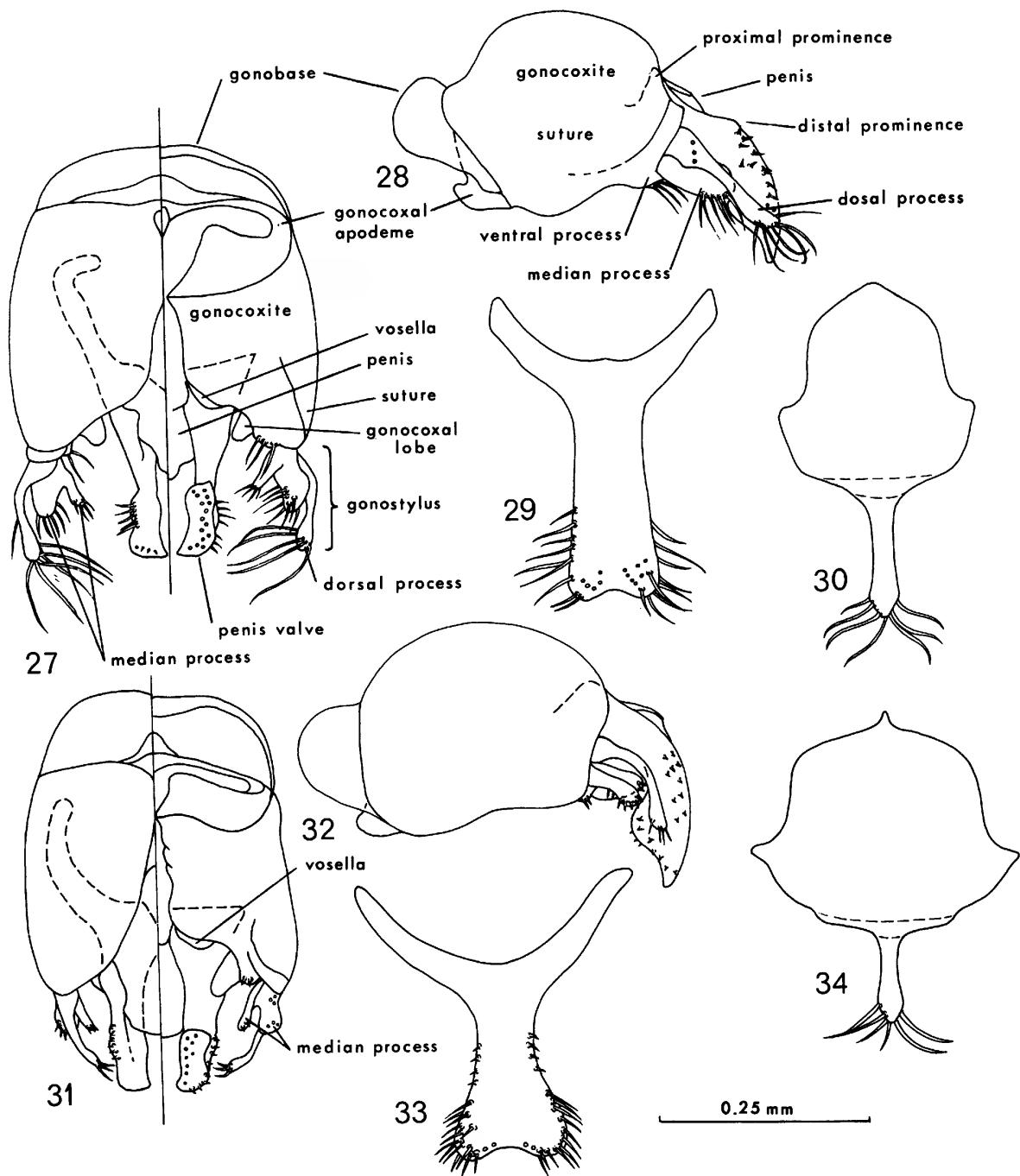
19, 1966 (E. I. Schlänger, M. Irwin, L. E. Peña). One female, Valparaiso, Valparaiso Prov., October 29, 1920 (P. Herbst); one female, Ramaditas, Valparaiso Prov., November 1, 1910. Four males and seven females, Peñuelas, Valparaiso Prov., October 28, 1969 (J. G. Rozen and L. E. Peña); five males and three females, same, October 6, 1969; one female, El Salto, Valparaiso Prov., October 12, 1967 (J. Solervicens). One female, Cuesta la Dormida, Valparaiso and Santiago Prov., Int. Biol. Program, October 20, 1971, on *Viola* (A. R. Moldenke, #31203). One female, Las Cabras, Mts. in Chillan area, S. Chillan Vulcano, 1500 m., Ñuble Prov., January 6-31, 1963 (L. E. Peña).

**Kelita penai Ehrenfeld and Rozen, new species**  
Figures 18, 31-34

**Diagnosis.** This species closely resembles *chilensis*, and can be separated from it by a combination of the following features: (1) the shallower, closer punctures of the mesonotum; (2) the roughened sculpture in the interpuncture spaces; (3) the fourth and fifth segments of the maxillary palpus being much shorter than the others; (4) the smaller size and more sparse pubescence; and (5) the posterior margin of the first submarginal cell longer than that of the second submarginal cell. The male differs from that of *chilensis* in possessing only proximal prominence on the penis valve; the female differs in that the pseudopygidium is triangular in shape, and not oval as in *chilensis*.

**Female.** Length 2.8 mm.

**Head.** Head black except for brown areas as described for *chilensis*. Decumbent pubescence whitish, less dense than in *chilensis*, same distribution. Long erect hairs whitish, same distribution as in *chilensis*. Portion of vertex between eyes and lateral ocelli, as seen from front in outline, more convex than in *chilensis*. Gena, as measured for *chilensis*, two-thirds as wide as eye. Antennal insertion and segments as described for *chilensis*. Supraclypeal area protuberant, not as prominent as in *chilensis*; pebbling as in *chilensis*; length as measured in *chilensis* about one-third length of clypeus. Frontal line more prominent than in *chilensis*. Clypeus protuberant, twice as broad as long; apex shining, impunctate; punc-



FIGS. 27-30. *Kelita chilensis*, male. 27. Genital capsule, dorsal (left side) and ventral views. 28. Same, lateral view. 29. Metasomal sternum VII, ventral view. 30. Metasomal sternum VIII, ventral view.

FIGS. 31-34. *Kelita penai*, male. 31. Genital capsule, dorsal (left side) and ventral views. 32. Same, lateral view. 33. Metasomal sternum VII, ventral view. 34. Metasomal sternum VIII, ventral view.

Scale refers to all figures.

tures large subapically, becoming smaller and more dense basally; integument shining between punctures. Ventral surface of head tessellate, not as strongly as in *chilensis*; erect pubescence more sparse than in *chilensis*. Hypostomal groove, as seen from below, slightly broader than distance from anterior edge of groove to ventral edge of eye. Mandible with anterior basal angle in line with inner edge of eye; mandible tapering to acute narrow tip; distance between basal angles greater than one-half length of mandible. Labrum strongly convex, twice as broad as long; entire apical margin straight; pyramidal prominences as described for *chilensis*. Proboscis long; maxillary palpi with second segment longer than others, segments four and five subequal and together less than length of second segment; maxillary palpi shorter than stipites, one-half length of galeae.

**Mesosoma.** Propleuron with ventrolateral edges rounded, lacking a tubercle as described for *tuberculata*. Mesoscutum slightly bronze-metallic, disc with punctures less than one puncture diameter apart, uniformly closely spaced throughout; interpuncture spaces more strongly pebbled than those of *chilensis*; whitish decumbent plumose hairs moderately dense along posterior edge and along medial sides of parapsidal lines, slightly denser in posterolateral areas; mesoscutum lacking long erect hairs. Scutellum with punctuation, sculpture, and color similar to mesoscutum, except punctures one to two puncture diameters apart; whitish short hairs simple, very sparse medially, whitish short decumbent plumose hairs in small lateral patches. Mesepisternum with pubescence as described for *chilensis*, except hairs entirely whitish. Metanotum more strongly convex than in *chilensis*, almost one-half length of mesoscutellum, sparsely covered with whitish short hairs. Dorsal portion of metepisternum as described for *chilensis*. Metasternum similar in shape to that of *chilensis*. Horizontal area of propodeum lacking, propodeum entirely declivitous. Wings slightly infuscated, lighter than in *chilensis*; second submarginal cell shorter than first along vein M; length of second submarginal cell along vein  $R_s$  one-half length along vein M; first recurrent vein entering second submarginal cell at point two vein widths from first transverse cubital. Legs as described for *chilensis*, except pubescence on procoxae less dense.

**Metasoma.** Terga I and II red-brown basally, red-yellow apically; terga III to V dark brown, with apical edge yellow-brown. Sternum I yellow-brown; remaining sterna dark brown; sterna covered with sparse erect white hairs. Pubescence of terga as described for *chilensis*, except plumose hairs more sparse. Anterior face of tergum I, as seen from side, flat, tapering anteriorly, at angle of 45 degrees to horizontal. Pseudopygidium triangular; length along apical edge of tergum subequal to height, apex more acute than in other species described here; color as described for *chilensis*. Pygidium broader than in *chilensis*; apex more strongly emarginate than in *chilensis*; color and pubescence as described for *chilensis*. Sternum V (fig. 18) with prominence as described for *chilensis*, but with apical process more pronounced; hairs sparser, less plumose. Posterior lobes of sternum VI as described for *chilensis*.

**Male.** As described for female except: antennal segments broader than long, weakly marked with light spots. Clypeal lamella above anterior angle of mandible less strongly produced than in *chilensis*. Pygidium as described for *chilensis*. Gonocoxite with length slightly less than twice width; gonocoxal apodeme strongly produced (figs. 31, 32). Gonostylus (figs. 31, 32) with dorsal, median, and ventral processes as described for *chilensis*, except dorsal process more slender. Penis valves with one acute prominence on dorsal surface, at base.

**Type Material.** Holotype male, allotype, one female paratype, El Pangue, 25 km. south of Vicuña, Coquimbo Prov., October 16, 1971 (J. G. Rozen and L. E. Peña).

**Etymology.** This species is named in honor of Señor Luis E. Peña, who contributed to this study in many ways.

#### Kelita toroi Ehrenfeld and Rozen, new species Figures 19, 22, 35-38

**Diagnosis.** This is the largest known species of the genus. It may be distinguished morphologically from the others by (1) the presence of punctures on the metasomal terga; (2) the shining interpuncture spaces on the mesonotum; and (3) the presence of decumbent pubescence on the face above the level of the scape, this pubes-

cence extending almost to the ocelli. The male differs from all other described species in that the median process of the gonostylus (figs. 35, 36) is large, broad and not bifurcated.

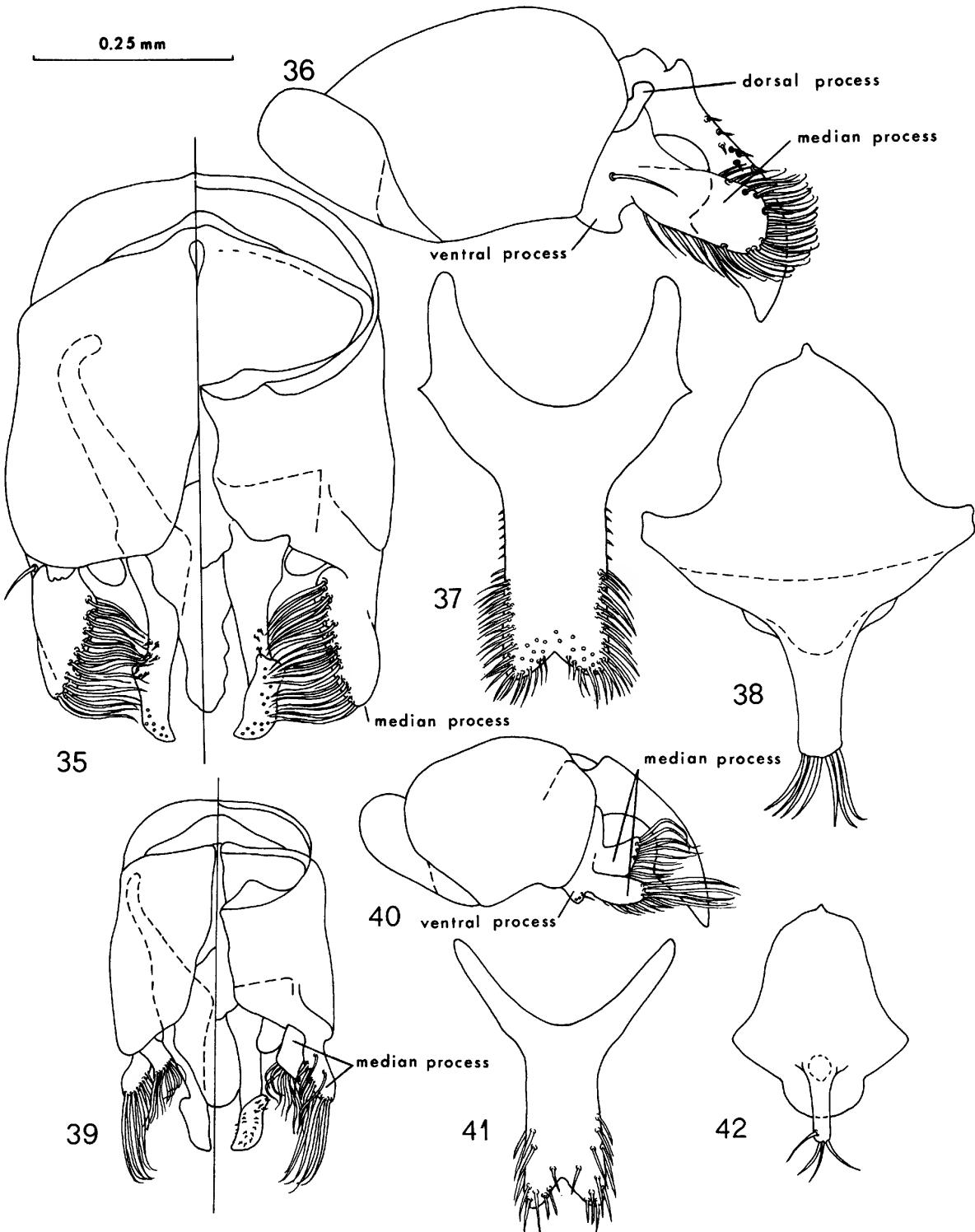
*Female.* Length 5.1-5.5 mm.

*Head.* Head mostly black; yellow-brown areas as described for *chilensis* except: mandible entirely red-brown, apical edge of clypeus black. Pubescence as described for *chilensis* except all hairs whitish; decumbent plumose hairs extending above level of scape nearly to ocelli. Portion of vertex between eyes and lateral ocelli, as seen from front in outline, straight. Gena as measured for *chilensis* slightly less than one-half as wide as width of eye. Antennae inserted opposite middle of eyes, higher on face than in *chilensis*; segments as in *chilensis*. Supraclypeal area very slightly protuberant, much less so than in *chilensis*; length about one-half length of clypeus as measured in *chilensis*; supraclypeal area with dense, wide punctures. Frontal line pronounced. Clypeus not protuberant, twice as broad as long; apex impunctate and shining, rest with broad punctures less than one puncture diameter apart; integument shining between punctures. Ventral surface of head punctate, roughened between punctures, convex; surface with sparse decumbent plumose hairs mixed with long simple erect hairs. Hypostomal groove, as seen from below, narrower than distance from anterior edge of groove to ventral edge of eye. Mandible with anterior articulation in line with inner edge of eye; mandible gradually tapering to rounded tip; distance between basal angles one-half mandibular length. Labrum strongly convex, much more so than in *chilensis*; apical two-thirds almost perpendicular to basal one-third; width almost twice length; apical area set off from basal area by ridge of black spicules; apical margin entirely straight, without central rounded area as described for *chilensis*; surface shining, heavily sculptured with very wide, shallow pits. Proboscis shorter than in *chilensis*, when in repose, extending barely beyond end of hypostomal groove; maxillary palpi with second segment longer than others, third to sixth segments subequal; maxillary palpi subequal to stipites, three-fourths as long as galeae.

*Mesosoma.* Prosternum (fig. 22) with small rounded prominences on ventrolateral edge much less pronounced than in *tuberculata*. Mesoscutum

black, nonmetallic; disc with punctures as described for *chilensis*; interpuncture spaces smooth and shining; pubescence as described for *chilensis* except hairs on disc of mesoscutum reddish, shorter, more highly plumose, hairs along posterior edge whitish, erect hairs whitish, very short; medial groove more deeply impressed than in *chilensis*, more highly pubescent. Scutellum with color, punctuation, sculpture as described for mesoscutum, except punctures more widely spaced; pubescence as in *chilensis* except erect hairs very short. Mesepisternum as described for *chilensis*, except hairs uniformly whitish. Metanotum about one-third length of scutellum; pubescence as described for *chilensis* except medial hairs reddish, lateral hairs whitish. Metepisternum lacking dense decumbent pubescence; hairs fine, suberect, nonplumose. Metasternum longer than wide; posterior process longer, more narrowly acute than in *chilensis*. Propodeum as described for *chilensis*. Wings faintly darkened; tips more dusky than in *chilensis*; submarginal cells subequal along vein M; length of second submarginal cell along vein  $R_s$  more than one-half length along vein M; first recurrent vein entering second submarginal cell at point one-fourth distance of total length of cell along vein M. Legs dark brown; light areas as in *chilensis* except areas smaller, less yellowish; tarsi all dark brown; procoxal pubescence as in *chilensis*; lamellate projection on hind tibia single, rectangular, slightly emarginate.

*Metasoma.* All terga black, except apical edges brown. Color of sterna same as terga. Terga I and IV punctate; dense whitish decumbent plumose hairs along apical edge except in center giving impression of bands; short simple yellowish hairs on disc of each tergum. Sterna with short sparse whitish hairs. Anterior face of tergum I rounded, densely covered with very short plumose white hairs, tapering broadly anteriorly, at angle of 45 degrees to horizontal, as seen from side. Pseudopygidium semicircular, with straight edge along apex of tergum, broader than long, brown (black in one specimen). Pygidium dark brown, wider than in *chilensis* with whitish hairs; carina around edge blackish; apex narrowly truncate, more deeply emarginate than in *chilensis*. Sternum V (fig. 19) with central prominence greatly elongate, reaching well beyond lateral parts of posterior margin of sternum; pubescence as described



FIGS. 35-38. *Kelita toroi*, male. 35. Genital capsule, dorsal (left side) and ventral views. 36. Same, lateral view. 37. Metasomal sternum VII, ventral view. 38. Metasomal sternum VIII, ventral view.

FIGS. 39-42. *Kelita tuberculata*, male. 39. Genital capsule, dorsal (left side) and ventral views. 40. Same, lateral view. 41. Metasomal sternum VII, ventral view. 42. Metasomal sternum VIII, ventral view. Scale refers to all figures.

for *chilensis*. Posterior lobes of sternum VI as described for *chilensis*.

*Male.* Length 5.2-5.6 mm.

As described for female except: antennal segments broader than long, not conspicuously spotted as described for *chilensis*. Epistomal suture and area between it and eye as described for *chilensis* except length of area equal to one-half length of clypeus; clypeus less strongly produced as lamella over anterior mandibular articulation than in *chilensis*. Mandible with length more than twice width at base; mandible tapering to acute tip. Pygidium dark brown with apex rounded, slightly notched; hairs white, simple, long; punctures wide, deep, contiguous medially, separated by one puncture diameter, smaller laterally. Gonocoxite (figs. 25, 26) with length less than one and one-half times width; gonocoaxal apodeme weakly produced. Gonostylus (figs. 25, 26) with dorsal process absent or minute; median process simple, not bifurcate, oblong, much larger than in *chilensis*, extending nearly to apex of penis valves, highly plumose along medial surfaces; ventral process similar to that of *chilensis*. Penis valves (fig. 36) each with two acute projections on dorsal surface, adjacent to each other, at point just beyond posterior margin of gonocoxite.

*Type Material.* Holotype male, allotype, Vicuña, Coquimbo Prov., October 18, 1971 (L. E. Peña). Paratypes: one male, 44 km. south of Copiapo, Atacama Prov., October 21, 1971 (J. G. Rozen and L. E. Peña). Two males and two females, El Pangue, 25 km. south of Vicuña, Coquimbo Prov., October 16, 1971 (Rozen and Peña); one male, same, October 1971 (H. Toro). Four males and two females, Fray Jorge National Park, 15 km. southwest of Pachingo, 100-200 m., Coquimbo Prov., October 20, 1966 (E. I. Schlinger and M. Irwin). One female, Llano de la Higuera, north of El Tofo, Coquimbo Prov., October 14, 1971 (J. G. Rozen and L. E. Peña).

*Etymology.* This species is named in honor of Prof. Haroldo Toro because of his assistance on this project and because of another reason known only to him and the authors.

**Kelita tuberculata** Ehrenfeld and Rozen,  
new species

Figures 20, 23, 39-42

*Diagnosis.* This species is entirely dark, like

*toroi*, but is much smaller. Morphologically, it can be recognized by the prominent acute tubercles (fig. 23) on the ventrolateral edges of the propleuron, and by the tessellation in the interpuncture spaces of the mesonotum. In the male, the quadrate shape of the inner lobe (fig. 39) of the median process of the gonostylus is distinctive.

*Female.* Length 3.2-3.6 mm.

*Head.* Head black; yellow-brown areas and red-brown areas as described for *chilensis*, except mandible entirely dark brown. Pubescence as described for *toroi*, except short hairs extending dorsally on face to height equal to length of scape, as described for *chilensis*; long hairs denser than in *toroi*. Portion of vertex between dorsal edge of eye and lateral ocelli, as seen from front in outline, convex, much more strongly so than in *chilensis*. Gena, as measured for *chilensis*, two-thirds as wide as width of eye, similar to that of *penai*. Antennae inserted at middle of eyes; mid-flagellar segments as long as broad. Supraclypeal area protuberant, similar to *penai*; length slightly greater than one-half length of clypeus; punctures small, sparse; interpuncture spaces weakly tessellate, except smooth and shining along epistomal suture. Frontal line very prominent. Clypeus protuberant, similar to *penai*; length slightly more than twice width; basal two-thirds with punctures as described for *chilensis*, apical one-third shining and impunctate. Paraocular area nearly flat, with groove much more shallow than in other species. Ventral surface of head faintly tessellate, flat, with sparse small punctures, sparse long erect hairs. Hypostomal groove, as seen from below, as broad as distance from anterior edge of groove to ventral edge of eye. Mandible with anterior articulation slightly anterior to inner edge of eye, similar to *chilensis*; mandible tapering to acute tip; width at base less than one-half length. Labrum less convex than in *toroi*, but more so than in *chilensis*, less than twice as broad as long; apical margin as described for *chilensis*; surface with small reddish tubercles medially; sculpture as in *toroi*. Proboscis shorter than in *chilensis*, barely extending in repose beyond end of hypostomal groove. Maxillary palpi with all segments subequal; palpi subequal to stipites, three fourths as long as galeae.

*Mesosoma.* Propleuron (fig. 23) with prominent acute tubercles on ventrolateral corner.

Mesoscutum black, nonmetallic as in *toroi*; disc with small punctures two to three puncture diameters apart, punctures larger, more closely spaced near posterior edge; interpuncture spaces dull, tessellate; short whitish decumbent branched hairs distributed densely along posterior and lateral edges, mesiad of parapsidal lines, along medial line, variably dense elsewhere; very sparse short simple erect hairs throughout; medial line strongly impressed, as in *toroi*. Scutellum with color, punctuation, and sculpture as described for mesoscutum; whitish decumbent plumose hairs moderately dense. Mesepisternum with pubescence as described for *toroi*. Metanotum about one-third length of scutellum; pubescence as described for *toroi*, except band of reddish hairs narrower. Dorsal portion of metepisternum as described for *toroi*. Metasternum longer than wide, as in *penai*; posterior process as described for *penai*. Horizontal area of propodeum lacking; propodeum entirely declivitous, as in *penai*. Wings clear, tips not darkened as in *chilensis* and *toroi*; second submarginal cell subequal to first submarginal cell along vein M; length of second submarginal cell along vein R<sub>s</sub> more than one-half length along vein M; first recurrent vein entering second submarginal cell at point one-fourth of total length of cell along vein M. Legs with color as described for *toroi*; lamellate projection on hind tibia as in *toroi*, except apex truncate, not notched; procoxa with white erect hairs, no plumose decumbent hairs as in *chilensis*.

**Metasoma.** Color of terga and sterna as described for *toroi*. Terga impunctate, unlike *toroi*. All terga with whitish plumose decumbent hairs moderately dense laterally, extending very sparsely along apical edge, absent medially, giving impression of bands, similar to *toroi*; shorter hairs as in *toroi*. Sterna lacking short hairs, long simple hairs moderately dense. Anterior face of tergum I, as seen from side, flat; other characters as described for *toroi*. Pseudopygidium black; shape as described for *toroi*; central region of thin, tapered setae larger than in other described species. Pygidium as described for *toroi*; pubescence yellowish in some specimens. Sternum V (fig. 20) with central prominence broadly triangular, reaching posterior margin of sternum but not as long as that of *toroi*.

**Male.** Length 2.9-3.2 mm.

As described for female except: antennae

shorter; segments broader than long. Epistomal suture as described for *toroi*. Pygidium dark brown, with apex rounded; punctures convex; hairs yellowish, short, simple. Gonocoxite (figs. 39, 40) with length one and one-half times width; gonocoaxal apodeme produced more than in *toroi*, less than in *chilensis*. Gonostylus (figs. 39, 40) possessing median and ventral processes; dorsal process minute or absent; median process bifurcate, with inner lobe shorter, quadrate, with dense, simple, long setae along posterior margin; outer lobe longer, rounded, similar to that of *chilensis*, with similar long setae distributed densely on posterior area. Penis valves more slender than in *chilensis*; valves with two dorsal projections, as in *chilensis*, except projections acute, adjacent to each other at point just beyond posterior margin of gonocoxite.

**Type Material.** Holotype male, allotype, five male and three female paratypes, Paipote, Atacama Prov., October 30, 1971 (J. G. Rozen and L. E. Peña). Other paratypes: two males and nine females, Paipote, Atacama Prov., October 12, 1971 (J. G. Rozen and L. E. Peña); four males and one female, same, October 11, 1971, Carretera Pan-Am al norte de La Serena, Coquimbo Prov., Int. Biol. Program, 1970-72 (A. R. Moldenke, #42192 refers to host and date). Two males and one female, Llano de La Higuera, north of El Tofo, Coquimbo Prov., October 15, 1971 (J. G. Rozen and L. E. Peña). Same, one male, October 14, 1971.

**Etymology.** The name for this species refers to the unique prominent ventrolateral tubercles found on the propleura.

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